* NOTICES *

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] while a blade rotates -- surface of revolution -- the dicing method that the travelling direction which carries out the dicing of the aforementioned blade about all of the outward trip return trip of the aforementioned relative displacement in the dicing method by which both-way movement of the inside is relatively carried out to a semiconductor wafer, and the dicing of the semiconductor wafer is carried out is in the state rotated so that it might turn down, and is characterized by carrying out the dicing of the semiconductor wafer
[Claim 2] while a blade rotates -- surface of revolution -- the dicing equipment which is in the state which rotated so that the travelling direction to which the aforementioned blade carries out the dicing of the inside about all of the outward trip return trip of the aforementioned relative displacement in the dicing equipment with which both-way movement is relatively carried out to a semiconductor wafer, and the dicing of the semiconductor wafer is carried out might turn down, and is characterized by to be constituted so that the dicing of the semiconductor wafer may carry out
[Claim 3] Dicing equipment according to claim 2 characterized by being constituted so that the axis of rotation of a blade may be reversed 180 degrees within a flat surface parallel to a semiconductor wafer.
[Claim 4] Dicing equipment according to claim 2 characterized by being constituted, respectively so that surface of revolution may be mutually equipped with the blade of an parallel couple at least and both blades may rotate to a right opposite direction mutually.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention is especially used for carrying out the dicing of the semiconductor wafer (henceforth a wafer), for example in the plant of a semiconductor device about dicing technology and the wheel dicing technology which carries out dicing with a diamond blade, and relates to effective technology

[0002]

[Description of the Prior Art] In the plant of a semiconductor device, in case a wafer is divided on a pellet, the dicing equipment which cuts a wafer along with a scribe line with a diamond blade (henceforth a blade) is used widely. Dicing equipment is equipped with the blade supported to revolve so that it might rotate to ** on the other hand within a vertical plane, while a blade rotates, outward trip movement is carried out along with the scribe line of 1, and a wafer is cut in a straight line. namely, subsequently While return movement of the blade is carried out with a rapid traverse in the state where it was estranged from the cutting side of a wafer, it is constituted by a wafer's being horizontally displaced relatively by only the predetermined pitch and repeating this operation after that so that two or more scribe lines may be cut by the blade.

[0003] By the way, there are a down cutting method rotated so that the travelling-direction side with which a blade cuts and goes to the cutting method with a blade may turn down, and the delivering-uppercut method rotated so that the travelling-direction side with which a blade cuts and goes may turn up. Since influence of the chipping on the front face of a wafer etc. cannot come out of the down cutting method easily while the state of a cutting side becomes good compared with the delivering-uppercut method, the down cutting method is in use now. In order to carry out the dicing of the wafer by the down cutting method in dicing equipment, it is always necessary to rotate a blade so that a travelling-direction side may turn down. Then, in conventional dicing equipment, a blade performs cutting only on an outward trip, and it consists of return trips so that only return movement may be carried out without performing cutting.

[0004] In addition, as an example which has expressed dicing technology, they are Kogyo Chosakai Publishing Co., Ltd., Inc. 1986 year 11 month 20 day issue

"electronic material November, 1986 issue separate volume" P40-P45 and ******.

[0005]
[Problem(s) to be Solved by the Invention] In conventional dicing equipment, in order that a blade may perform cutting only on an outward trip, the return time of a return trip becomes useless and has the trouble that working capacity falls. If major-diameter-izing of a wafer and the miniaturization of pellet size will progress from now on, the loss of the return time of a blade when cutting is not performed will become a very serious problem.
[0006] The purpose of this invention is to offer the dicing technology which can cancel the loss of the return time of a blade, maintaining a good cutting state.
[0007] The other purposes and the new feature will become clear from description and the accompanying drawing of this specification at the aforementioned row of this invention.
[0008]
[Means for Solving the Problem] It will be as follows if the outline of a typical thing is explained among invention indicated in this application.
[0009] namely, -- while a blade rotates -- surface of revolution -- it is characterized by being constituted so that the axis of rotation of a blade may reverse inside 180 degrees within a flat surface parallel to a semiconductor wafer in the dicing equipment with which both-way movement is relatively carried out to a semiconductor wafer, and the dicing of the semiconductor wafer is carried out
[0010] It faces that the aforementioned blade cuts a semiconductor wafer in an outward trip, and the aforementioned blade is rotated so that the travelling direction which cuts and goes may turn down. Subsequently, it faces that the aforementioned blade cuts a semiconductor wafer in a return trip, and after the axis of rotation is reversed 180 degrees in the parallel side of a semiconductor wafer, the aforementioned blade is sent relatively [direction / of a return trip], and cuts a semiconductor wafer. After the axis of rotation of a blade is reversed 180 degrees, in order that a blade may start cutting, even if it faces cutting of this return trip, the blade is in the state of rotating so that travelling direction may turn down. Subsequently, it faces that the aforementioned blade cuts a semiconductor wafer in an outward trip again, and after the axis of rotation is again reversed 180 degrees in the parallel side of a semiconductor wafer, the aforementioned blade is sent relatively [direction / of an outward trip], and cuts a semiconductor wafer. And after the axis of rotation of a blade is reversed 180 degrees, in order that a

blade may start cutting, even if it faces cutting of this outward trip also at this time, the blade is in the state of rotating so that travelling direction may turn down.
[0011] That is, it will rotate so that the travelling direction which cuts and goes about all of an outward trip return trip may turn down, and a blade will carry out the dicing of the semiconductor wafer. And since influence of the chipping on the front face of a wafer etc. cannot come out of the down cutting method easily while the state of a cutting side becomes good compared with the delivering-uppercut method, the dicing state of a semiconductor wafer becomes very good about all of an outward trip return trip. And since it does not necessarily rotate reversely rotation of a blade, the decline in working efficiency is suppressed.
[0012]
[Embodiments of the Invention] the principal part of the dicing equipment whose drawing 1 is 1 operation gestalt of this invention -- being shown -- **** -- (a) -- the part under cutting of an outward trip -- cutting front view and (b) -- the part under cutting of a return trip -- it is cutting front view drawing 2 -- a part of the dicing equipment -- it is an ellipsis perspective diagram
[0013] The dicing equipment applied to this invention in this operation gestalt is in the state (state of down cutting) rotated so that the travelling direction which cuts and goes about all of the outward trip return trip of movement in which a blade carries out dicing might turn down, and it is constituted so that the dicing of the wafer may be carried out. Dicing equipment is equipped with the chuck table 10 holding the wafer 1 as a dicing-ed object, and the chuck table 10 is constituted so that both-way movement may be carried out by Y directional movement equipment 11 on the other hand at ** (it considers as the direction of Y hereafter.). That is, Y directional movement equipment 11 is constituted so that the pitch delivery operation of the chuck table 10 may be carried out in an outward trip corresponding to the pitch of the scribe line set as the wafer 1 and a rapid-traverse operation may be carried out in a return trip.
[0014] X directional movement equipment 13 is horizontally laid in the direction of X which is a direction which intersects perpendicularly above the chuck table 10 in the direction of Y, and the lifting and holding of the X directional movement equipment 13 are carried out so that both-way movement may be carried out at a Z direction by the Z direction move equipment 12 furnished downward perpendicular direction (it may be hereafter called Z direction)] in the stand (not shown). Between this X directional movement equipment 13, the X table 14 is supported, where a bridge is constructed horizontally, and X directional movement

equipment 13 makes a straight line carry out continuation movement of the X table 14 with the speed stabilized about both the outward trip and the return trip. The theta table 15 is horizontally furnished to the inferior surface of tongue in the center section of the X table 14, and the theta table 15 is constituted so that it may rotate 180 degrees in the level surface with a rotary actuator 16. That is, the rotary actuator 16 is constituted so that both-way reversal of the theta table 15 may be precisely carried out by a unit of 180 degrees.

[0015] The cross-section KO typeface-like bracket 17 hangs perpendicularly, and is installed by the inferior surface of tongue of the theta table 15, and the axis of rotation 18 by which a rotation drive is carried out with a rotation driving gear (not shown) is passed over the bracket 17 at a level with the direction of Y. It is attached in the end section of the axis of rotation 18 possible [exchange] so that a blade 19 may intersect perpendicularly, and a blade 19 is contained in the vertical plane of the direction of X.

[0016] It is allotted to the machine frame periphery of a rotary actuator 16 so that a reversal precision detection sensor (henceforth a sensor) may be located in the vertical plane in which the couple and the blade 19 were contained at both the sides of the direction of Y of a blade 19, and it is installed downward [perpendicular direction], respectively. On the other hand, a reflecting plate 21 is allotted to a bracket 17 so that it may be located in the vertical plane in which the couple and the blade 19 were contained at both the sides of the direction of Y of a blade 19, and it is installed by perpendicular direction facing up, respectively. The sensor 20 is constituted by the reflex photosensor and detects the amount of gaps to the criteria position of a vertical plane where the blade 19 was contained by detecting the reflected light from a reflecting plate 21. A sensor 20 transmits a detection result to the controller (not shown) of a rotary actuator 16, and the controller of a rotary actuator 16 carries out feedback control of the rotary actuator 16 based on a detection result.

[0017] Next, by explaining an operation of the dicing equipment concerning the aforementioned composition explains the dicing method which is 1 operation gestalt of this invention.

[0018] The wafer 1 which should be carried out dicing after this is precisely positioned by the chuck table 10, and is held in other places at it. By making semiconductor integrated circuit equipment (IC) in a grid pattern in the so-called last process in the manufacturing process of a semiconductor device, this wafer 1 is virtually formed in parallel and the right angle in the scribe line 3 at the orientation

flat (henceforth a cage hula) 2.

[0019] If the chuck table 10 held where the wafer 1 which should be carried out dicing after this is positioned precisely is suspended by Y directional movement equipment 11 at a position, while the direction table 14 of X will be moved to the head position of the direction of X by X directional movement equipment 13, alignment of the scribe line 3 on the imagination which the chuck table 10 is moved by Y directional movement equipment 11, and should be carried out dicing to the beginning with it is carried out to a blade 19.

[0020] If alignment of the blade 19 is carried out relatively [line / scribe / 3], while the airframe which supported the blade 19 with Z direction move equipment 12 will descend on the whole, the X table 14 is sent in the direction of X at the rate of predetermined by X directional movement equipment 13. If it rotates with this delivery operation as the blade 19 is shown to the arrow A of drawing 1 (a) by predetermined rotational speed with the rotation driving gear, since the scribe line 3 of a wafer 1 is cut by the blade 19, the cutting line 4 will be formed in a wafer 1 along with the scribe line 3. That is, on the occasion of cutting of this outward trip, it will rotate so that the travelling-direction side which cuts and goes may turn down, and a blade 19 will carry out down cutting of the wafer 1.

[0021] Thus, since it will be hard to come out of the influence of the chipping to the front face of a wafer 1 etc. while the state of a cutting side becomes good if a blade 19 rotates [a travelling-direction side] so that it may turn down, and down cutting of the wafer 1 is carried out, the cutting state after dicing becomes very good.

[0022] If the blade 19 which carried out down cutting of the first scribe line [in / a wafer 1 / as mentioned above] 3 reaches the opposite-side termination in the direction of X of a wafer 1, the whole airframe which supported the blade 19 with Z direction move equipment 12 will go up. If a blade 19 separates from a wafer 1 completely, when the theta table 15 rotates 180 degrees with a rotary actuator 16, the axis of rotation 18 of a blade 19 will rotate 180 degrees in the level surface. That is, a blade 19 is reversed 180 degrees focusing on a normal axis, and the result of a blade 19 is replaced.

[0023] If a blade 19 is reversed 180 degrees, it will be floodlighted by the reflecting plate 21 from a sensor 20, and reversal precision will be detected based on the reflected light. That is, a sensor 20 calculates the error of the target position after 180-degree reversal of an ideal, and the control position after actual reversal from the amount of gaps of the reflected light, and calculates the correction value which cancels the error. Based on a detection result, the controller of a rotary actuator

16 carries out minute rotation of the theta table 15, and is precisely located in a target position. Incidentally, the operation of correction value may be performed by the sensor 20 side, and may be performed by the controller side of a rotary actuator 16.

[0024] Subsequently, one pitch of chuck tables 10 is moved by Y directional movement equipment 11, and alignment of 2 Motome's scribe line 3 which should next be cut is carried out to the surface of revolution of a blade 19.

[0025] If alignment of the following scribe line 3 is carried out to a blade 19 while a blade 19 is reversed 180 degrees precisely as mentioned above, while the airframe which supported the blade 19 with Z direction move equipment 12 will descend on the whole, the X table 14 is sent in the direction of X of a retrose at the rate of predetermined with an outward trip by X directional movement equipment 13. If it rotates with delivery operation of this return trip as the blade 19 is shown to the arrow B of drawing 1 (b) by predetermined rotational speed with the rotation driving gear, since the scribe line 3 of a wafer 1 is cut by the blade 19, the cutting line 4 will be formed in a wafer 1 along with the scribe line 3. That is, even if it faces cutting of this return trip, it will rotate so that the travelling-direction side which cuts and goes may turn down, and a blade 19 will carry out down cutting of the wafer.

[0026] Thus, since it will be hard to come out of the influence of the chipping to the front face of a wafer 1 etc. while the state of a cutting side becomes good like an outward trip if a travelling-direction side rotates so that a blade 19 may turn down also in a return trip, and down cutting of the wafer 1 is carried out, the cutting state after dicing becomes very good.

[0027] If the blade 19 which carried out down cutting of 2 Motome's scribe line [in / a wafer 1 / as mentioned above] 3 reaches the head side edge in the direction of X of a wafer 1, the whole airframe which supported the blade 19 with Z direction move equipment 12 will go up. If a blade 19 deserts a wafer 1 completely, when the theta table 15 rotates 180 degrees again with a rotary actuator 16, the axis of rotation 18 of a blade 19 will rotate 180 degrees in the level surface. That is, a blade 19 is reversed 180 degrees focusing on a normal axis, and the result of a blade 19 is changed to the original state.

[0028] If a blade 19 is reversed 180 degrees again, feedback control by the controller of a sensor 20 and a rotary actuator 16 mentioned above will be carried out again. Subsequently, one pitch of chuck tables 10 is moved by Y directional movement equipment 11, and alignment of 3 Motome's scribe line 3 which should

next be cut is carried out to a blade 19.

[0029] Henceforth, the aforementioned operation is repeated, and along with all the scribe lines 3, the cutting line 4 is formed one by one, and goes. And if the cutting line 4 is formed about all the scribe lines 3 that intersect perpendicularly with the cage hula 2, the chuck table 10 will rotate 90 degrees. Subsequently, the aforementioned operation is repeated, and about all the scribe lines 3 parallel to the cage hula 2, the cutting line 4 is formed and it goes.

[0030] According to the aforementioned operation gestalt, the following effect is acquired.

(1) Since it can suppress that bad influences, such as a chipping, occur on a wafer front face on the occasion of cutting by making it rotate so that the travelling direction which cuts a blade about all of an outward trip return trip, and goes may turn down, and cutting a wafer in the state of down cutting, the state after cutting of a wafer is maintainable good about all of an outward trip return trip.

[0031] (2) Since it is not necessary to face carrying out down cutting about all of an outward trip return trip by reversing the axis of rotation of a blade 180 degrees in the level surface, and to make rotation of a blade right-rotate reversely, it can prevent that working efficiency falls.

[0032] drawing 3 shows the dicing equipment which is the operation gestalt 2 of this invention -- it is an ellipsis perspective diagram in part

[0033] while right rotation blade 19A and reverse rotation blade 19B are arranged in on a straight line in series and the point that this operation gestalt 2 differs from the aforementioned operation gestalt 1 is furnished, respectively instead of reversing the blade of one sheet 180 degrees -- the Z direction move equipments 12A and 12B of a couple -- each -- **** -- it is in the point constituted so that it may go up and down

[0034] On the occasion of cutting of an outward trip, down cutting of the wafer 1 is carried out by right rotation blade 19A along with the scribe line 3. Subsequently, after right rotation blade 19A goes up by Z direction move equipment 12A for outward trips and a wafer 1 is deserted on the occasion of cutting of a return trip, reverse rotation blade 19B descends by Z direction move equipment 12B for return trips, and down cutting of the next scribe line of a wafer 1 is carried out by reverse rotation blade 19B. Also in this operation gestalt 2, since down cutting of the wafer 1 is carried out also in any of an outward trip return trip, the same effect as the aforementioned operation gestalt 1 is acquired.

[0035] drawing 4 shows the dicing equipment which is the operation gestalt 3 of this

invention -- it is an ellipsis perspective diagram in part

[0036] while right rotation blade 19A and reverse rotation blade 19B are put in order in parallel mutually and the point that this operation gestalt 3 differs from the aforementioned operation gestalt 1 is furnished, respectively instead of reversing the blade of one sheet 180 degrees -- the Z direction move equipments 12A and 12B of a couple -- each -- **** -- it is in the point constituted so that it may go up and down

[0037] On the occasion of cutting of an outward trip, down cutting of the wafer 1 is carried out by right rotation blade 19A along with the scribe line 3. Subsequently, after right rotation blade 19A goes up by Z direction move equipment 12A for outward trips and a wafer 1 is deserted on the occasion of cutting of a return trip, reverse rotation blade 19B descends by Z direction move equipment 12B for return trips, and down cutting of the next scribe line 3 of a wafer 1 is carried out by reverse rotation blade 19B. Also in this operation gestalt 3, since down cutting of the wafer 1 is carried out also in any of an outward trip return trip, the same effect as the aforementioned operation gestalt 1 is acquired.

[0038] Although invention made by this invention person above was concretely explained based on the operation gestalt, it cannot be overemphasized by this invention that it can change variously in the range which is not limited to the aforementioned operation gestalt and does not deviate from the summary.

[0039] For example, it is desirable not to restrict as composition to which a blade and a wafer are moved relatively using the structure of the aforementioned operation gestalt, but to set up suitably corresponding to dicing conditions etc.

[0040] As composition for reversing a blade 180 degrees precisely, it cannot restrict using the aforementioned structure, but the structure which measures parallelism with a blade, a scribe line, or a cutting line, the structure which carries out alignment of the blade to the datum line assumed beforehand can be used.

[0041]

[Effect of the Invention] It will be as follows if the effect acquired by the typical thing among invention indicated in this application is explained briefly.

[0042] Since it can suppress that bad influences, such as a chipping, occur on a wafer front face on the occasion of cutting by making it rotate so that the travelling direction which cuts a blade about all of an outward trip return trip, and goes may turn down, and cutting a wafer in the state of down cutting, the state after cutting of a wafer is maintainable good about all of an outward trip return trip.

[0043] Since it is not necessary to face carrying out down cutting about all of an

outward trip return trip, and to make rotation of a blade right-rotate reversely, it can prevent that working efficiency falls.

[Translation done.]